Structure Silicon monolithic integrated circuit

Product Name Audio music player for cellular phone

Product No. **BU8903GU**

Features The audio decoding HE-AAC, AAC-LC and MP3

## Absolute Maximum Ratings

| Parameter | Symbol | Rating | Unit | Remarks |
|---|---|---|---|---|
| Analog supply voltage | AVDD | -0.3 ~ 4.5 | V | AVDD |
| Digital I/O supply voltage | VDDIO | -0.3 ~ 4.5 | V | DVDDIO |
| Digital I/O2 supply voltage | VDDIO2 | -0.3 ~ 4.5 | V | DVDDIO2 |
| CORE supply voltage | VDDCO | -0.3 ~ 2.16 | V | DVDDCORE |
| Voltage applied to pins | VIN | DVSS-0.3 ~ VDDIO+0.3 | V | |
| Power dissipation | Pd | 1300 | mW | (*1) |
| Storage temperature range | Tstg | -50 ~ 125 | °C | |
| Operating temperature range | Topr | -30 ~ 85 | °C | |

(*1) Note: Reduce to 13.0mW/℃ when Ta = 25℃ or above

○Recommended Operating Power Supply Voltage Range

| Parameter | Symbol | rating | | | Unit | Remarks |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Analog supply voltage | AVDD | 2.7 | 2.8 | 3.3 | V | AVDD |
| Digital I/O supply voltage | DVDDIO | DVDDCO | 1.8 | 3.3 | V | DVDDIO |
| Digital I/O2 supply voltage | VDDIO2 | DVDDCO | 3.0 | 3.3 | V | DVDDIO2 |
| Digital CORE supply voltage | VDDCO | 1.40 | 1.5 | 1.65 | V | DVDDCORE |
| MCLK1 input frequency | FMCLK1 | 32.768 | - | 26 000 | KHz | 32.768kHz or 2.688MHz~26MHz |
| MCLK2 input frequency | FMCLK2 | 2688 | - | 26 000 | KHz | sine wave / square wave 2.688MHz~26MHz |
| MCLK duty | DMCLK | 40 | 50 | 60 | % | |
| Analog pin's load resistance | RL | 10 | - | - | kΩ | |

This chip is not designed to protect itself against radioactive rays.

Status of this document

The English version of this document is the formal specification. A customer may use this translation version only for a reference to help reading the formal version. If there are any differences in translation version of this document,formal version takes priority.

○ Electrical Characteristics

OVERALL electrical characteristics (Unless otherwise noted, Ta = 25℃)

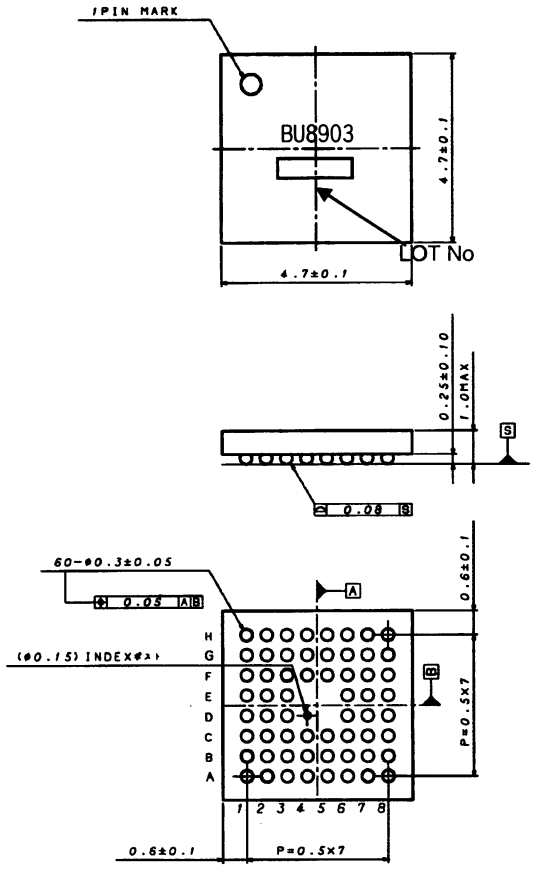
| Parameter | Symbol | Rating | | | Unit | Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Digital DC characteristics | | | | | | |
| High-level input voltage | VIH | DVDDIO*0.7 | - | - | V | |
| Low-level input voltage | VIL | - | - | DVDDIO *0.3 | V | |
| High-level input current | IIH | - | - | 1 | uA | VIH=VDDIO |
| Low-level input current | IIL | -1 | - | - | uA | VIL=DVSS |
| High-level output voltage | VOH | DVDDIO*0.8 | - | - | V | IOH= -2mA (9) |
| Low-level output voltage | VOL | - | - | DVDDIO *0.2 | V | IOL= 2mA (10) |
| Analog DC characteristics | DVDDCORE=1.5 [V], DVDDIO=3.0[V], AVDD=3.0[V], PLLVDD=3.0[V] | | | | | |
| VREF pin voltage | VAGND | 1.30 | 1.45 | 1.60 | V | IOUT=0A(no load) |
| Analog pin voltage | VOUT | 1.30 | 1.45 | 1.60 | V | IOUT=0A(no load) Not playing |
| General characteristics | | | | | | |
| VREF pin rise time | TRVR | - | 8 | 25 | mS | When CVREF = 1uF, NRST=L→H |
| Analog pin characteristics | DVDDCORE=1.5[V], DVDDIO=3.0[V], AVDD=3.0[V], PLLVDD=3.0[V] | | | | | |
| Analog amplitude | VMAX | 1.60 | 1.74 | 1.90 | Vp-p | Theoretical value for dynamic range |
| Power consumption | DVDDCORE=1.5 [V], DVDDIO=3.0[V], AVDD=3.0[V], PLLVDD=3.0[V] | | | | | |
| Analog Idd1 (DA Converter) | AIDD1 | - | 3.6 | 5 | mA | Playing |
| Analog Idd2 (PLLVDD) | AIDD2 | - | 0.6 | 1 | mA | PLL related. Core clock dependent. |
| Digital Idd11 (DVDDCORE) | DIDD11 | - | 6.6 | 8 | mA | Playing MP3 |
| Digital Idd11 (DVDDCORE) | DIDD11 | - | 7.9 | 11 | mA | Playing AAC-LC |
| Digital Idd11 (DVDDCORE) | DIDD11 | - | 14.7 | 17 | mA | Playing HE-AAC |
| Digital Idd12 (DVDDIO+DVDDIO2) | DIDD12 | - | 0.4/0.5 | 1.0 | mA | Playing |
| Analog Idd3 | AIDD2 | - | - | 2 | uA | Standby mode |
| Digital Idd20 (DVDDCORE) | DIDD20 | - | 20 | 150 | uA | Standby mode (8) |
| Digital Idd21 (DVDDIO+DVDDIO2) | DIDD21 | - | - | 5 | uA | Standby mode |

DAC characteristics Typical value are at Ta=25[degree C] / AVDD=3.0[V]. Output load = no load .

| Parameter | Symbol | Ratings | | | Unit | Note/conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Input Resolution | | | 16 | | Bits | |
| Output range | | 1.45±0.80 | 1.45±0.87 | 1.45±0.95 | V | A-weight Center level = 1.45V. |
| Total harmonic distortion +Noise | THD+N | 70 (1) | 85 | - | dB | fs=44.1,48kHz, 20kHz LPF |
| Cross-talk | Xtalk | 70 (1) | 90 | - | dB | 1kHz ouput, 1kHz BPF |
| Signal to noise ratio | SNR | 75 (1) | 90(1) | - | dB | fs=44.1,48kHz, A-weight |
| Power Supply Rejection Ratio | PSRR | 50 (2) | 60 | - | dB | A-weight,1kHz BPF |

(1): Input frequency (f_in = 1kHz), 0 dBFs (FullScale).

○ External measure and View



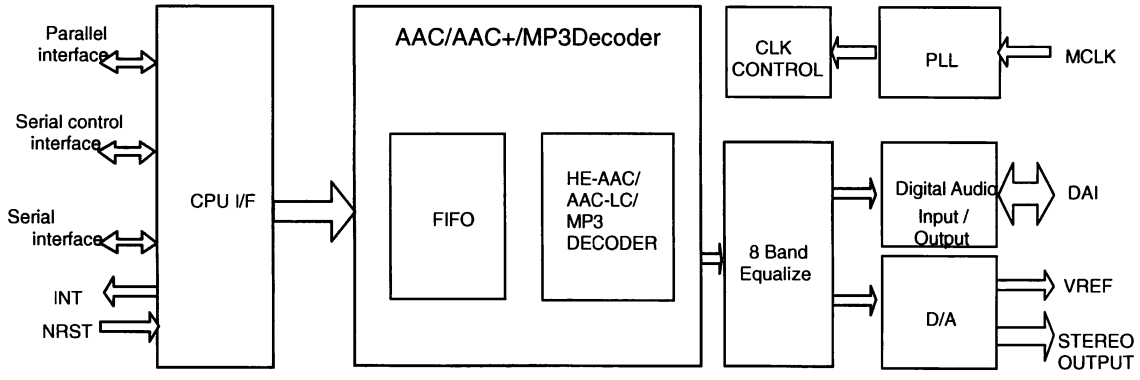

VCSP85H4 (60Pin) (Unit: mm)

○Pin layout diagram

| Pin No. | Pin name | Pin No. | Pin name | Pin No. | Pin name |
|---|---|---|---|---|---|
| A1 | TM0 | C5 | IFSEL | F5 | VREFSEL |
| A2 | D11 | C6 | IICADDR | F6 | VREF |
| A3 | SPISDO(WR) | C7 | COREDOWN | F7 | LOUT |
| A4 | DVDDCORE | C8 | DIGLR | F8 | MOUT |
| A5 | DVSS | D1 | DVSS | G1 | D8 |
| A6 | MCLK1 | D2 | D4 | G2 | PLLVSS |
| A7 | D13 | D3 | D5 | G3 | PLLVDD |
| A8 | TM1 | D6 | DIGCK | G4 | IICSDA |
| B1 | D10 | D7 | DIGDOUT | G5 | DVDDIO |
| B2 | INT | D8 | DIGDIN | G6 | AVDD |
| B3 | SPISDI(A0) | E1 | DVDDCORE | G7 | AVSS |
| B4 | DVDDIO | E2 | D3 | G8 | NC |
| B5 | SPICLK(RD) | E3 | D2 | H1 | TM2 |
| B6 | D12 | E6 | DVDDIO2 | H2 | D9 |
| B7 | D14 | E7 | DACMCK | H3 | MCLK2 |
| B8 | D15 | E8 | DVSS | H4 | DVSS |
| C1 | D6 | F1 | D1 | H5 | DVDDCORE |
| C2 | D7 | F2 | D0 | H6 | ROUT |
| C3 | NRST | F3 | PLLFILTER | H7 | NC |
| C4 | SPISEL(CS) | F4 | IICSCL | H8 | NC |

Test pin setting TM0=L, TM1=L, TM2=L

○ Block diagram



○ Cautions on use

(1) Absolute Maximum Ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.

(2) Operating conditions

These conditions represent a range within which characteristics can be provided approximately as expected. The electrical characteristics are guaranteed under the conditions of each parameter.

(3) Reverse connection of power supply connector

The reverse connection of power supply connector can break down ICs. Take protective measures against the breakdown due to the reverse connection, such as mounting an external diode between the power supply and the IC's power supply terminal.

(4) Power supply line

Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines.In this regard, for the digital block power supply and the analog block power supply, even though these power supplies has the same level of potential, separate the power supply pattern for the digital block from that for the analog block, thus suppressing the diffraction of digital noises to the analog block power supply resulting from impedance common to the wiring patterns. For the GND line, give consideration to design the patterns in a similar manner.

Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. At the same time, in order to use an electrolytic capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the occurrence of capacity dropout at a low temperature, thus determining the constant.

(5) GND voltage

Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.

(6) Short circuit between terminals and erroneous mounting

In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.

(7) Operation in strong electromagnetic field

Be noted that using ICs in the strong electromagnetic field can malfunction them.

(8) Inspection with set PCB

On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, in order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.

(9)Input terminals

In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

(10) Ground wiring pattern

If small-signal GND and large-current GND are provided, It will be recommended to separate the large-current GND pattern from the small-signal GND pattern and establish a single ground at the reference point of the set PCB so that resistance to the wiring pattern and voltage fluctuations due to a large current will cause no fluctuations in voltages of the small-signal GND. Pay attention not to cause fluctuations in the GND wiring pattern of external parts as well.

(11) External capacitor

In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.

(12) Others

In case of use this LSI, please peruse some other detail documents, we called ,Technical note, Functinal description, Application note.

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